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EXAMINER	
RUGGLES, JOHN S	

ART UNIT	PAPER NUMBER
1756	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/708,010	WATTS, ANDREW J.	
	Examiner	Art Unit	
	John Ruggles	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 February 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 February 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/2/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because the original drawings filed on 2/2/04 are informal. Applicant is advised to employ the services of a competent patent draftsperson outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

Specification

The title of the invention is not fully descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed (all of the claims are drawn to only methods of making EAPSMs).

The following title is suggested: --COMMON SECOND LEVEL FRAME EXPOSURE METHODS FOR MAKING EMBEDDED ATTENUATED PHASE SHIFT MASKS.

35 U.S.C. 112, first paragraph, requires the specification to be written in "full, clear, concise, and exact terms." The specification is replete with terms, which are not clear, concise and exact. The specification should be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. Examples of some unclear, inexact or verbose terms used in the specification are: (1) on page 2 in paragraph [0005] lines 14-16, the phrase "a second exposure is made to selectively remove the opaque material but to leave the opaque and the area surrounding the area critical structures" is unclear and should be changed (to e.g., --a second exposure is made to

selectively remove the opaque material in the area of critical structures, but to leave the opaque material [[and]] in the area surrounding the area of critical structures--, etc.), in order to clarify which part or area of the opaque material is removed (e.g., in the area of critical structures only, etc.); (2) in [0018] line 2, "first level exposure of the EAPSM" should be changed to --first level exposure, developing, and etching of the EAPSM--, in order to better correspond with the extent to which the process of making the EAPSM has progressed as shown in Figure 2, to which this brief description refers; (3) in [0024] lines 10-11, the chemical formula "$MoSi_xO$ - $_yN_z$" has been split between these two lines at the position shown by the hyphen (-) added to this formula and should be corrected so that it appears together in a single line (without the hyphen (-)) as -- ~~$MoSi_xO-{}_yN_z$~~ $MoSi_xO_yN_z$--; (4) in [0026] line 9, "image forming segments 232a-22c are" should also be corrected to -- ~~image forming~~ phase shifting segments ~~232a-22c~~ 22a, 22b, and 22c are used for forming images--, in order to correspond with the latter reference characters for phase shifting segments described in line 7 and found in Figure 2, to which this passage refers; and (5) also, throughout the specification (e.g., at [0011] line 5, etc.), the multilayer phase shift mask (PSM) "substrate" having a layer of PS material and a layer of opaque material on a base supporting substrate should be changed to --~~substrate~~ blank--, at each appropriate occurrence in order to avoid confusion between the multilayer substrate (blank) and the base substrate as the bottom layer thereof. Note that due to the number of errors, those listed here are merely *examples* of the corrections needed and do *not* represent an exhaustive list thereof.

Appropriate correction is required. An amendment filed making all appropriate corrections must be accompanied by a statement that the amendment contains no new matter and

also by a brief description specifically pointing out which portion of the original specification provides support for each of these corrections.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contain subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. While these claims recite methods of making **embedded** attenuated phase shift masks (EAPSMs, emphasis added), the specification does not describe **how** these APSMs were made embedded (e.g., by embedding material into at least one layer of this mask, etc.). However, for the purpose of this Office action and in order to advance the prosecution of this application, these claims have been interpreted broadly to include any attenuated PSM (APSM) having the other recited limitations, ***without having to be embedded***.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, lines 3-5, 6, 8, 12, 19, and 20 are unclear with regard to the use of the term "substrate" and also with regard to whether or not the last step completes or finishes the EAPSM. In particular, the multilayer phase shift mask (PSM) "substrate" having a layer of PS material and a layer of opaque material on a base supporting substrate should be changed to --~~substrate~~ blank--, at each appropriate occurrence throughout the claims in order to avoid confusion between the multilayer substrate (blank) and the base substrate as the bottom layer thereof. For example in claim 1, "a phase shift mask substrate having a layer of phase shifting material and a layer of an opaque material" (lines 3-5) should be changed to --a phase shift mask ~~substrate~~ blank having a layer of phase shifting material and a layer of an opaque material on a substrate--; "the substrate" (in lines 6 and 8) should be changed to --the ~~substrate~~ blank--; "the substrate" (in lines 12 and 19) should be changed to --the ~~substrate~~ blank having first level phase shifting image segments--, at both occurrences; and "the critical structure areas" (in line 20) should also be clarified to --the critical structure areas to finish the EAPSM--. Claims 2-11 depend on claim 1.

In claim 12 lines 3-5, 6, 9-10, 13, 21, and 22 as well as in claim 18 lines 3-5, 6, 9-10, 13, 22, and 23, similar changes corresponding to those stated above for various lines of claim 1 should also be made to claims 12 and 18 in order to improve clarity for the same reasons as specifically stated for claim 1 above. Claims 13-17 depend on claim 12 and claims 19-20 depend on claim 18.

In both of claim 8 lines 3-4 and claim 9 line 4, the phrase "the EA**S**PM" (emphasis added) lacks proper antecedent basis. This should be rectified by simply correcting the spelling of this phrase at both occurrences to --the [[EA**S**PM]] EAPSM--, which does find antecedent

basis in claim 1 lines 2 and 11 via claim 4 for the first occurrence in claim 8 as well as in claim 1 lines 2 and 11 via claim 3 for the second occurrence in claim 9.

Likewise, in both of claim 15 lines 4-5 and claim 18 lines 26-27, the phrase "the EA**S**PM" (emphasis added) lacks proper antecedent basis. This should be rectified by simply correcting the spelling of this phrase at all four occurrences to --the [[EA**S**PM]] EAPSM--, which does find antecedent basis in claim 12 lines 2 and 12 via claim 13 for the occurrences in claim 15 as well as in claim 18 lines 2, 12, and 25 for the occurrences in claim 18. Claims 19-20 depend on claim 18.

Claim Rejections - 35 USC § 102/103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1 and 3 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Tzu (US 6,423,455).

Tzu teaches a method for fabricating a photomask or mask, particularly an attenuated phase shift mask (APSM, title, abstract). Figure 7 shows an APSM having patterned central active or critical APS layer portions (22b and 22c) on a transparent substrate (20) and an

additional overlying opaque outer border region (24a' and 24d') on APS layer portions (22a and 22d). Manufacturing efficiency is enhanced by employing a cutout mask with flood radiation exposure (reading on the instant common second level frame exposure or simultaneous projection exposure, *instant claim 3*), rather than a lithographically defined exposure or direct writing, for patterning the (second) resist to define the opaque outer border region (c10/L23-35). The method steps for making this APSM include: (a) lithographic or direct write patterning of a (first) resist (26, preferably a positive resist such as polymethylmethacrylate, PMMA) over a multilayered blank having an opaque layer (24, e.g., chrome (Cr) or any other metal, etc.) on an APS layer (22, e.g., leaky Cr, Cr oxide or nitride, CrON, MoSiON, etc.) on a transparent substrate (20, e.g., glass, quartz, etc.) as shown in Figure 2 (c5/L59 to c7/L15), (b) etching through both the opaque layer and the APS layer as shown in Figure 3 (c7/L16-55), (c) exposing the central critical device region of a (second) overlying resist layer with a radiation beam (30, typically and preferably ultraviolet (UV) radiation) through a cutout mask (28a and 28d, a single frame exposure mask) as shown in Figure 4 (c7/L56 to c8/L60), (d) developing the second resist to uncover the central critical device region as shown in Figure 5 (c8/L61 to c9/L35), (e) etching to remove the opaque layer in the central critical device region as shown in Figure 6 (c9/L41-67), and (f) stripping for removing the remaining second resist to form the APSM as shown in Figure 7 (c10/L1-22, having a structure comparable to the instant Figure 6 embedded APSM (EAPSM), *instant claim 1*). In related prior art, Tzu et al. in US 5,783,337 describes the use of two focused electron beam exposures (electron beam direct writing) at different intensity/doses of the same overlying resist layer to form an APSM (e.g., EAPSM, etc.) having an opaque outer border

surrounding a central active or critical device region on the APSM to avoid spurious exposure when using the APSM (c2/L66 to c3/L15).

Claims 2 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Tzu (US 6,423,455) alone or additionally in view of Glendinning (US 4,797,334).

While preferably using a PMMA positive resist as the first resist for lithographic or direct write patterning before etching underlying layers and further recognizing the utility of an electron beam for direct writing of a resist to pattern underlying layers by etching to form an APSM (e.g., EAPSM, etc.), Tzu does not specifically teach electron beam direct writing to pattern the first PMMA positive resist (*instant claims 2 and 12*).

However, electron beam direct-writing for patterning a PMMA positive resist has been very well known for some time (e.g., for subsequent etching of an underlying metal layer on a radiation mask, etc.) to form a high precision, high quality, defect free patterned mask, as shown by Glendinning (title, abstract, c2/L41-42, c4/L11-16).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention in the method of making an APSM or an EAPSM taught by Tzu to have used electron beam direct writing to pattern the first PMMA positive resist, either because Tzu recognized the previously known utility of an electron beam for direct writing of a resist to pattern underlying layers by etching to form an APSM (e.g., EAPSM, etc.) or additionally because electron beam direct-writing for patterning a PMMA positive resist has been very well known for some time (e.g., for subsequent etching of an underlying metal layer on a radiation mask, etc.) to form a high precision, high quality, defect free patterned mask (as shown by Glendinning, *instant claims 2 and 12*).

Claims 4 and 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tzu (US 6,423,455) in view of either Chiang (US 4,343,877) or Irie (US 6,710,847).

Tzu does not specifically teach all the limitations of the instant claims.

Chiang teaches the production and use of improved masks having various types of identification (ID) codes to identify individual masks in a mask set, as well as (corresponding) ID codes printed on each wafer chip to make integrated circuit devices (abstract, c10/L7-21, claims 8, 14, and 16), particularly for avoiding mistaken use of a wrong mask that could result in the production of defective (patterned) wafers (c3/L2-4) while still providing semiconductor wafers having an improved yield of functioning integrated circuit chips (c3/L51-53). Thus, identifying a mask in this fashion has been known for quite some time and would be expected to facilitate storage, future retrieval, and use of such an identified mask either with a suitable second mask in the same mask set or with another compatible mask having the same chip or field size (*instant claims 4 and 8-9*).

Irie teaches an exposure method and an exposure apparatus (title) that involves patterning a working reticle or mask by stitching together plural exposures from a plurality of different master reticles or masks (e.g., in a mask set, etc.) that were previously stored and held in accordance with ID information on the masks (abstract), each of which is identified with ID information (e.g., a barcode mark, etc., claim 4) to keep separate track of each master mask, so that the number of work steps for making the working mask using the plurality of master masks is reduced and occurrence of work errors can be prevented (abstract). The working mask can alternatively be a halftone or attenuated PSM (c15/L36-49, APSM). Thus, identifying a mask in this fashion is known and would be expected to facilitate storage, future retrieval, and use of

such an identified mask either with a suitable second mask in the same mask set or with another compatible mask having the same chip or field size (*instant claims 4 and 8-9*).

It would have been obvious to one of ordinary skill in the art at the time of the invention in the method of making an APSM or an EAPSM (as a working mask) taught by Tzu to ID and store the cutout mask or single frame exposure mask (as a master mask) for facilitating future retrieval and use of such an identified and stored mask either with a suitable second mask in the same mask set or with another compatible mask having the same chip or field size (such as the EAPSM, *instant claims 4 and 8-9*), because identification of a stored mask would reasonably be expected either (i) to avoid the mistaken use of a wrong mask (such as a cutout single frame exposure mask or an EAPSM made thereby) that could result in the production of defective (patterned) wafers while still providing semiconductor wafers having an improved yield of functioning integrated circuit chips (as taught by Chiang) or (ii) to make keeping separate track of each master mask easier, so that the number of work steps for making the working mask (such as an EAPSM) using a plurality of master masks is reduced and occurrence of work errors can be prevented (as taught by Irie).

Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tzu (US 6,423,455) in view of either Chiang (US 4,343,877) or Irie (US 6,710,847) and further in view of Aita (US 5,405,734).

While teaching other aspects of the instant claims, neither Tzu, Chiang, nor Irie specifically teach all the limitations of *instant claims 5-7*.

Aita teaches a method of correcting a patterned film on a substrate or sample (such as a photomask, reticle, or mask, c1/L7-9) by focused ion beam (FIB) etching, but without creating

undesired scars or processing grooves (e.g., to avoid riverbed effects, etc.) in the mask substrate surface. This is achieved by protecting the substrate only where it is not covered by the patterned film and then FIB etching to repair the mask substrate (title, abstract). In Figure 3(a), a negative photoresist or resist 31 has been applied onto the surface of a sample substrate 33 from which a patterned film 32 is to be removed. Then, the negative photoresist 31 is selectively exposed by irradiating ultraviolet (UV) light 36 (claim 2) from the lower major surface side or backside of the substrate 33, as shown in Figure 3(b). Only the negative resist on substrate 33 that does not cover patterned film portion 32 is exposed, to constitute exposed negative resist 35, while the resist covering portion over 32 is unexposed negative resist 34 (which requires that the substrate be sufficiently transparent to allow backside UV light exposure of the overlying negative resist 35, while the excess patterned film must be sufficiently opaque to prevent UV light exposure of the overlying negative resist 34 directly on the excess patterned film). The unexposed negative resist 34 on patterned film portion 32 is developed or stripped, leaving the portions of substrate 33, which are not covered by patterned film portion 32, covered by the exposed negative resist 35 as shown in Figure 3(c). As shown in Figure 1(a), a scanning FIB 1 irradiates the excess patterned film portion 2, in order to remove it, without irradiating any part of the substrate 4. Since the substrate 4 is masked with the patterned negative resist 3 immediately adjacent to and contacting with the edges of the excess patterned film portion 2, the substrate 4 is not etched or damaged by the FIB, as shown in Figure 1(b) (c2/L22-58 and corresponding claims 1 and 3-4). The removal of an excess defect of a patterned film to repair the mask by FIB is performed without causing any unnecessary or harmful processing of the

mask substrate adjacent to the excess defect (c3/L3-6, understood to include avoiding FIB riverbed effects or staining).

It would have been obvious to one of ordinary skill in the art at the time of the invention in the method of making an APSM or an EAPSM (as a working mask) that includes identifying and storing a corresponding cutout mask or single frame exposure mask (as a master mask) for facilitating future retrieval and use of such an identified and stored mask either with a suitable second mask in the same mask set or with another compatible mask having the same chip or field size (such as the EAPSM, as taught by Tzu and either Chiang or Irie) to repair any damage on the EAPSM or to remanufacture the EAPSM via either reworking or redesigning the central critical device region of the EAPSM (e.g., in order to make the EAPSM more suitable for either patterning further devices of the same kind via EAPSM repair or patterning differently designed devices without having to start from scratch, etc.) by backside exposure through the identified and stored corresponding single frame exposure mask (as a master mask) of a protective resist layer over those areas of the EAPSM that are to be repaired, reworked, or redesigned in the manner including selective FIB removal of undesired areas of material not protected by adjacent protective resist (as taught by Aita, allowing removal of undesired opaque and/or APS materials with suitable lithographic exposure conditions, an appropriate protective resist, and a selectively controlled FIB removal method), because this method would reasonably be expected to protect the remaining transparent substrate of the EAPSM from undesired etching or damage, such as riverbed effects or staining, that would otherwise be caused by the FIB (just as taught by Aita, *instant claims 5-7*).

Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tzu (US 6,423,455) in view of either Narushima et al. (US 6,549,277) or Inao et al. (US 2001/0036581).

Tzu does not specifically teach whether the UV exposure reduction ratio is either 1:1 (*instant claim 10*) or other than 1:1 (*instant claim 11*) through the cutout mask or single frame exposure mask for patterning the second resist to define the opaque outer border region on the APSM (e.g., EAPSM, etc.).

However, since the instantly claimed reduction ratios of either 1:1 or other than 1:1 are exhaustive of all reduction ratios, Tzu would necessarily have used one or the other of these reduction ratios for the UV exposure of the second resist to define the opaque outer border region on the APSM or EAPSM. Narushima et al. exemplify the common choice of reduction exposure at reduction ratios other than 1:1 in a projection exposure system, such as that shown in Figure 4, for exposing a photosensitive or resist layer on a base or a substrate (14) by an excimer laser light source (1, KrF wavelength = 248nm, c5/L28-30) for exposure light passing through various optical components including a patterned reticle or mask (11) and further optical components including a reduction projection optical system (13) between the mask (11) and the resist coated substrate (14) so that the projected mask pattern is reduced on the resist (at a reduction ratio of mask pattern size to resist image size of e.g., 4:1, 5:1, 6:1, etc., c6/L25-37, all of which are other than 1:1, *instant claim 11*).

Inao et al. teach a near field exposure method, apparatus, and corresponding near field mask (title, abstract) for extending the lower limit on patterned dimensions of no smaller than about 0.1μm (100nm) that is normally imposed by the wavelength of currently used near UV laser exposure light (paragraphs [0002]-[0005]). To extend the patterned dimensions of a resist

below 100nm (which is much smaller than the wavelength of exposure light that is preferably in the range of about 200nm to 500nm to allow use of a wide variety of known resists at relatively low cost to provide a high degree of process freedom [[0055]-[0056]), the small amount of light seeping out of a micro-aperture smaller than 100nm can be used at very close range at a distance of less than 100nm (near field exposure) down to 0nm (contact exposure) between a patterned mask and the resist [0006], [0043]-[0044], [0053]. Such close exposure distance even to the point of direct contact between the near field mask and the resist would clearly require a 1:1 correspondence or reduction ratio between the pattern dimensions on the near field mask and those patterned onto the resist (*instant claim 10*).

It would have been obvious to one of ordinary skill in the art at the time of the invention in the method of making an APSM or an EAPSM (as a working mask) that includes UV exposure through the cutout mask or single frame exposure mask for patterning the second resist to define the opaque outer border region on the APSM or the EAPSM (as taught by Tzu) to have conducted the UV exposure at a common reduction ratio (of e.g., 4:1, 5:1, 6:1, etc., as taught by Narushima et al., each of which are other than 1:1, *instant claim 11*), because such reduction ratios are very well known in the art of resist exposure and would provide a reasonable expectation of success in the UV exposure for resist patterning to make the APSM or the EAPSM. It would also have been obvious in the UV exposure through the cutout mask or single frame exposure mask for patterning the second resist to define the opaque outer border region on the APSM or the EAPSM (as taught by Tzu) to alternatively carry out the UV exposure in the near field region, including contact exposure, at a reduction ratio of 1:1 (*instant claim 10*), because this would provide a reasonable expectation of success for extending the patterned

dimensions in the resist to a finer resolution while still permitting the use of a UV exposure wavelength in a range of about 200nm to 500nm that allows the use of a wide variety of known resists at relatively low cost to provide a high degree of process freedom (as taught by Inao et al.).

Claims 13, 15, 18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Tzu (US 6,423,455) alone or additionally in view of Glendinning (US 4,797,334), further in view of either Chiang (US 4,343,877) or Irie (US 6,710,847).

Neither Tzu nor Glendinning specifically teaches all the limitations of *instant claims 13, 15, 18, and 20.*

The teachings of Chiang and Irie are discussed above.

It would have been obvious to one of ordinary skill in the art at the time of the invention in the method of making an APSM or an EAPSM (as a working mask) that includes electron beam direct writing of the first resist, as taught by either Tzu alone or additionally with Glendinning, to ID and store the cutout mask or single frame exposure mask (as a master mask) for facilitating future retrieval and use of such an identified and stored mask either with a suitable second mask in the same mask set or with another compatible mask having the same chip or field size (such as the EAPSM, *instant claims 13, 15, 18, and 20*), because identification of a stored mask would reasonably be expected either (i) to avoid the mistaken use of a wrong mask (such as a cutout single frame exposure mask or an EAPSM made thereby) that could result in the production of defective (patterned) wafers while still providing semiconductor wafers having an improved yield of functioning integrated circuit chips (as taught by Chiang) or (ii) to make keeping separate track of each master mask easier, so that the number of work steps

for making the working mask (such as an EAPSM) using a plurality of master masks is reduced and occurrence of work errors can be prevented (as taught by Irie).

Claims 14 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Tzu (US 6,423,455) alone or additionally in view of Glendinning (US 4,797,334), further in view of either Chiang (US 4,343,877) or Irie (US 6,710,847), and further in view of Aita (US 5,405,734).

While teaching other aspects of the instant claims, neither Tzu, Glendinning, Chiang, nor Irie specifically teaches all the limitations of *instant claims 14 and 19*.

The teachings of Aita are discussed above.

It would have been obvious to one of ordinary skill in the art at the time of the invention in the method of making an APSM or an EAPSM (as a working mask) that includes electron beam direct writing of the first resist as well as identifying and storing a corresponding cutout mask or single frame exposure mask (as a master mask) for facilitating future retrieval and use of such an identified and stored mask either with a suitable second mask in the same mask set or with another compatible mask having the same chip or field size (such as the EAPSM, as taught by Tzu alone or additionally with Glendinning, and either Chiang or Irie) to repair any damage on the EAPSM or to remanufacture the EAPSM via either reworking or redesigning the central critical device region of the EAPSM (e.g., in order to make the EAPSM more suitable for either patterning further devices of the same kind via EAPSM repair or patterning differently designed devices without having to start from scratch, etc.) by backside exposure through the identified and stored corresponding single frame exposure mask (as a master mask) of a protective resist layer over those areas of the EAPSM that are to be repaired, reworked, or redesigned in the

manner including selective FIB removal of undesired areas of material not protected by adjacent protective resist (as taught by Aita, allowing removal of undesired opaque and/or APS materials with suitable lithographic exposure conditions, an appropriate protective resist, and a selectively controlled FIB removal method), because this method would reasonably be expected to protect the remaining transparent substrate of the EAPSM from undesired etching or damage, such as riverbed effects or staining, that would otherwise be caused by the FIB (just as taught by Aita, *instant claims 14 and 19*).

Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Tzu (US 6,423,455) alone or additionally in view of Glendinning (US 4,797,334), further in view of either Narushima et al. (US 6,549,277) or Inao et al. (US 2001/0036581).

Neither Tzu nor Glendinning specifically teaches a UV exposure reduction ratio that is either 1:1 (*instant claim 16*) or other than 1:1 (*instant claim 17*) through the cutout mask or single frame exposure mask for patterning the second resist to define the opaque outer border region on the APSM (e.g., EAPSM, etc.).

However, since the instantly claimed reduction ratios of either 1:1 or other than 1:1 are exhaustive of all reduction ratios, either Tzu alone or additionally with Glendinning would necessarily have used one or the other of these reduction ratios for the UV exposure of the second resist to define the opaque outer border region on the APSM or EAPSM.

The teachings of Narushima et al. and Inao et al. are discussed above.

It would have been obvious to one of ordinary skill in the art at the time of the invention in the method of making an APSM or an EAPSM (as a working mask) that includes electron beam direct writing of the first resist and UV exposure through the cutout mask or single frame

exposure mask for patterning the second resist to define the opaque outer border region on the APSM or the EAPSM (as taught by either Tzu alone or additionally with Glendinning) to have conducted the UV exposure at a common reduction ratio (of e.g., 4:1, 5:1, 6:1, etc., as taught by Narushima et al., each of which are other than 1:1, *instant claim 16*), because such reduction ratios are very well known in the art of resist exposure and would provide a reasonable expectation of success in the UV exposure for resist patterning to make the APSM or the EAPSM. It would also have been obvious in the UV exposure through the cutout mask or single frame exposure mask for patterning the second resist to define the opaque outer border region on the APSM or the EAPSM (as taught by either Tzu alone or additionally with Glendinning) to alternatively carry out the UV exposure in the near field region, including contact exposure, at a reduction ratio of 1:1 (*instant claim 17*), because this would provide a reasonable expectation of success for extending the patterned dimensions in the resist to a finer resolution while still permitting the use of a UV exposure wavelength in a range of about 200nm to 500nm that allows the use of a wide variety of known resists at relatively low cost to provide a high degree of process freedom (as taught by Inao et al.).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Ruggles whose telephone number is 571-272-1390. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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